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Original research

Chemical compounds and antibacterial and antioxidant properties of citron (*Citrus medica* L.) peel essential oil

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A B S T R A C T

In this research, essential oil of citron peel was extracted through water distillation by clevenger apparatus and then its chemical composition and antibacterial and antioxidant properties were evaluated. GC-MS analysis showed the major identified components of the essential oil included limonene (33.60%), myristicin (24.36%), carvacrol (8.1%), apiol (5.34%), β-bisabolene (4.40%) and α-bergamotene (2.67%). The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) for Staphylococcus aureus and Escherichia coli were respectively determined as 62.5, 250, 125 and 500 µg/ml, respectively. The total phenol content of the essential oil was 6.0 ± 0.03 mg gallic acid/g sample. The scavenging activity of DPPH radicals based on IC50 was 19.587 ± 0.011 µg/ml. This result indicated less performance in comparison with BHT, gallic acid and ascorbic acid. Also, although the total flavonoids content of citron fruit extract was 3.4 mg quercetin/g sample, no flavonoid compound was detected in the essential oil.

Keywords: Citron, Essential oil, Chemical composition, Antibacterial, Antioxidant

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1. Introduction

Negative effects of synthetic antioxidants due to their mutagenicity, toxicity and carcinogenesis have led to use the natural antioxidants as substitute for them (Sakanaka et al., 2005; Golshan Tafti & Panahi, 2019). Based on the findings of researchers, essential oils or volatile oils of herbs and fruits are rich sources of phenolic compounds with strong antimicrobial and antioxidant properties (Guo et al., 2003; Azhdarzadeh et al., 2017), and increasing public awareness about the negative impacts caused by excessive use of synthetic chemicals has led to many researches on them (Hyldgaard et al., 2012; Rahati Noveir, 2018).

The essential oils produced from aromatic plants have been used from ancient times as flavoring and preservative in foods and also as medicine for curing diseases. These materials, which are rich in phenolic compounds, increase the duration of shelf life of foods by delaying lipid oxidation or controlling the growth of microorganisms (Shan et al., 2007; Chun et al., 2005; Fadavi et al., 2018).

Citrus belongs to the Rutaceae family and Aurantiodeae subfamily. This fruit is rich in vitamins A, B, and C which have medicinal and nutritional aspects. Citron with scientific name of *Citrus medica* L. is specie of citrus that its history dates back to 1300 B.C. Although the fresh citron fruit does not have many commercial and edible aspects, jam and marmalade produced from its very thick peel have beneficial effects on the purify the blood, strengthen the heart, stomach and liver, promotion of treatment of diarrhea, diabetes and alzheimer disease (Adedeji et al., 2007; Sood et al., 2009; Pasandide et al., 2017; He et al., 2014).

Citron peel, as a rich resource of phenolic compounds, has the beneficial effects on human health and biological activity which, unfortunately, is usually rejected as wastes. Hence, the use those for production of essential oil can be valuable in terms of both nutraceutical parameters and environmentally friendly.

Therefore, according to the importance of essential oils in food and drug industries, the aim of the work was the extraction, identification and evaluation of chemical compounds and antioxidant and antimicrobial activities of citron peel essential oil (CPEO).

2. Material and Methods

2.1. Materials

Citron fruits were prepared from a citrus orchard in Bam, Kerman, Iran. Chemicals such as sulfuric acid, acetic acid, sodium sulfate, sodium carbonate, aluminum chloride, barium chloride,

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